Micro Engineering Company

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# ASSEMBLY INSTRUCTIONS
# TALL STEEL VIADUCT
## Standard Bridge
**75-514 HO 150 ft, 75-516 HOn3 150 ft**
**75-515 HO 210 ft, 75-517 HOn3 210 ft**

## I. GENERAL

• The Micro Engineering Tall Steel Viaduct models an intermediate weight bridge that is found throughout the U.S. on modern as well as early twentieth century railroads. This spectacular type of bridge is used to span deep valleys with a stronger, more permanent bridge than the wooden trestles it often replaced. The bridge can be built for straight or curved track down to an 18" radius on the 150 ft. bridge. As assembly proceeds, it's fun to see how the weak, floppy individual parts go together to form a strong, sturdy bridge.

• Most parts in this kit are made of injection molded styrene plastic and can be glued with MEK solvent or a styrene cement (such as Testors®). We strongly recommend using a glass tube cement applicator. If using Delrin® plastic track, glue it and the white metal parts with a cyanoacrylate (CA) or a rubber based cement (such as Pliobond®, available from Micro Engineering).

• Read each instruction step completely before proceeding with that step. Refer to the photos and box label for reference.

## II. TALL STEEL VIADUCT ADD-ON KITS

• Tall Steel Viaduct bridges can be customized in a variety of ways or entirely new bridges can be designed and built. There are a number of basic and add-on HO-HOn3 Tall Steel Viaduct kits for increasing the length, height, or configuration of the basic bridges. See the Micro Engineering Tall Steel Viaduct brochure sheet for a list of these kits.

## III. NOTES

• Figure 1 identifies the major assemblies and subassemblies of the Tall Steel Viaduct. For the purposes of these instructions, the bridge stories are numbered from the bridge deck down. The Tower Height Extension kit #75-546 adds one or two more stories, identified as the fourth and fifth story, to the base of the stock, three story towers.

• Figure 1 also illustrates a finished HO 150 ft. Tall Steel Viaduct. The HO 210 ft. bridge is illustrated in fig. 35 on page 10 of these instructions.

• The sequence of assembly for the bridge is: 1. Construct the **bent assemblies** (two per tower); 2. Construct the **tower struts** (six per tower); 3. Assemble a **tower** (two per kit) using two bent assemblies, six tower struts, and six pairs of tower X-braces; 4. Construct the **bridge spans** (five); 5. Construct the **bridge deck**; 6. Attach **Bridge Flex-Trak** to the bridge deck. 7. Attach the bridge deck to the towers.

• Parts **(6)**, **(7)**, **(8)**, and **(9)** have excess plastic that extends from their gusset plates at one or both ends. The excess plastic should be trimmed from these parts. Parts **(10)**, **(11)**, **(12)**, **(13)**, and **(20)** have similar extensions off their ends that are part of the part. Do **not** trim the extensions off these parts. See figure 2.

**Fig. 1 Assemblies / Terminology**

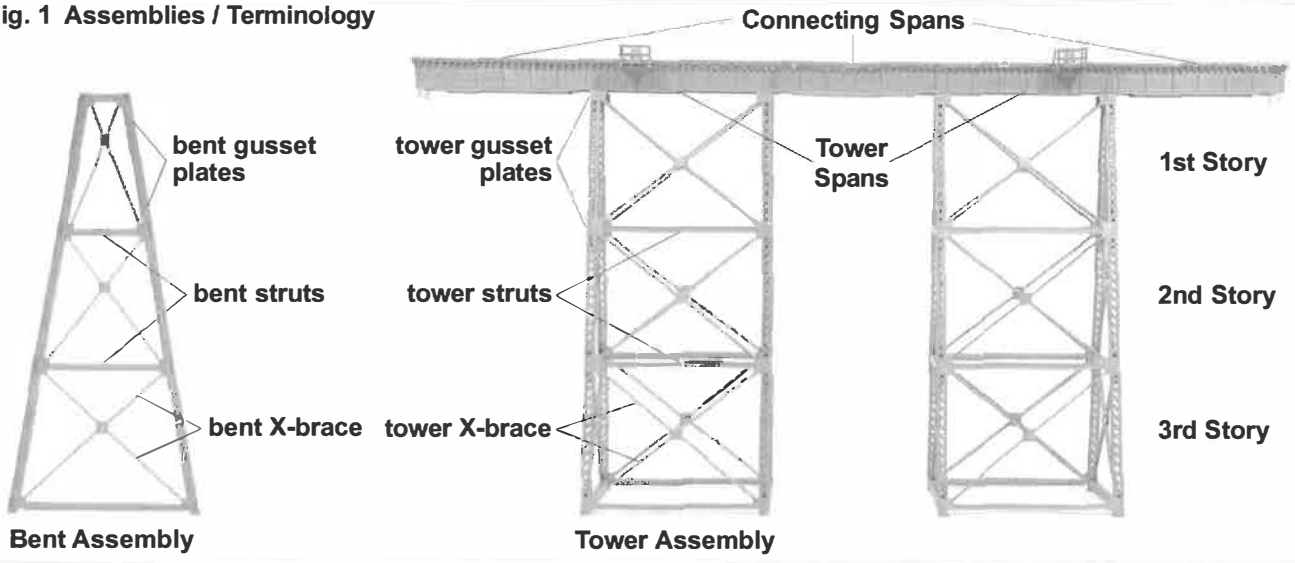
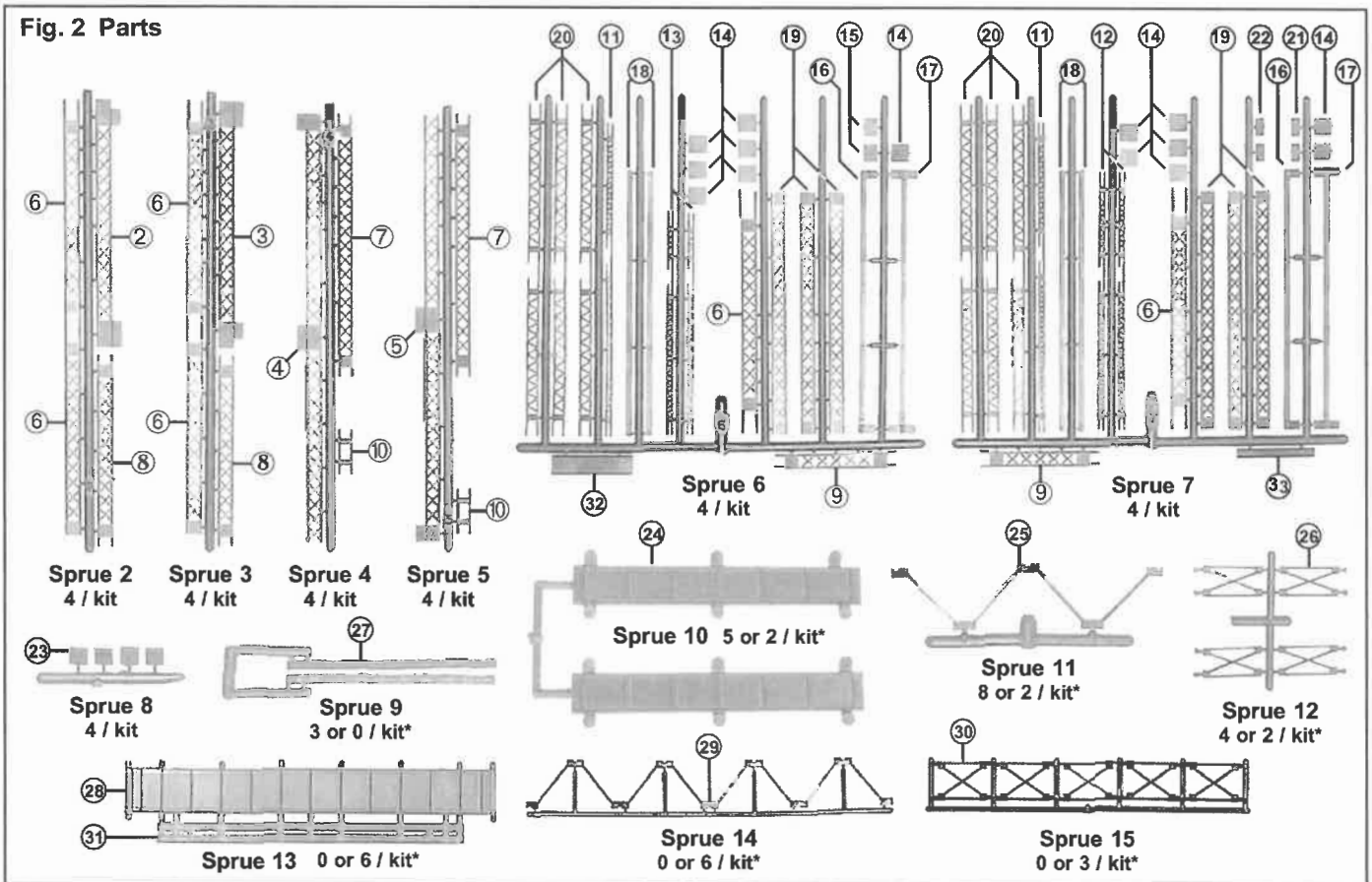


**Fig. 2 Parts**




| Part No. | Part Name | Sprue No. | Parts Needed |
|---|---|---|---|
| 1. | **bent half** (not shown) | 1 | 8 |
| 2. | **outside bent lattice, lower LH** | 2 | 4 |
| 3. | **outside bent lattice, lower RH** | 3 | 4 |
| 4. | **outside bent lattice, upper LH** | 4 | 4 |
| 5. | **outside bent lattice, upper RH** | 5 | 4 |
| 6. | **inside bent lattice** | 2, 3, 6, 7 | 24 |
| 7. | **bent strut lattice, 3rd story** | 4, 5 | 8 |
| 8. | **bent strut lattice, 2nd story** | 2, 3 | 8 |
| 9. | **bent strut lattice, 1st story** | 6, 7 | 8 |
| 10. | **bent strut brace, top** | 4, 5 | 8 |
| 11. | **bent X-brace, 3rd story** | 6, 7 | 8 |
| 12. | **bent X-brace, 2nd story** | 7 | 8 |
| 13. | **bent X-brace, 1st story** | 6 | 8 |
| 14. | **large rivet plate** | 6, 7 | 40 |
| 15. | **small rivet plate** | 6 | 8 |
| 16. | **tower strut side, inside 3rd story** | 6, 7 | 4 |
| 17. | **tower strut side, inside 1 & 2 story** | 6, 7 | 8 |
| 18. | **tower strut side, outside** | 6, 7 | 12 |
| 19. | **tower strut lattice** | 6, 7 | 24 |
| 20. | **tower X-brace** | 6, 7 | 24 |
| 21. | **top tower gusset plate, left-hand** | 7 | 4 |
| 22. | **top tower gusset plate, right-hand** | 7 | 4 |
| 23. | **bearing plates** | 8 | 16 |
| 24. | **30' girder** (150' / 210') | 10 | 10/4 |
| 25. | **30' lateral bracing** (150' / 210') | 11 | 8/2 |
| 26. | **30' X-brace** (150' / 210') | 12 | 15/6 |
| 27. | **30' reinforcing plate** (150' / 210') | 9 | 6/0 |
| 28. | **50' girder** (210' kit only) | 13 | 6 |
| 29. | **50' lateral bracing** (210' kit only) | 14 | 6 |
| 30. | **50' X-brace** (210' kit only) | 15 | 15 |
| 31. | **50' reinforcing plate** (210' kit only) | 13 | 6 |
| 32. | **I-beam, for HO** (210' kit only) | 6 | 4 |
| 33. | **I-beam, for HOn3** (210' kit only) | 7 | 4 |
| 34. | **bridge shoes, white metal** (not shown) | --- | 4 |

*** numbers are for 150 ft. kit and 210 ft. kit respectively**

## IV. PARTS

• The parts photo and parts list are shown in figure 2. The part numbers are keyed to the photo. Extra parts that will not be used are included in your kit. The sprue configuration and the number of sprues of some HOn3 parts is slightly different than that shown in the parts photo and list.

• Some sprues have a molded in sprue number. Keep the parts on their sprue until ready to assemble so the parts remain keyed to the sprue number. When cutting the plastic and white metal parts from their sprues, file or trim off any flash, ejector pads, or gate nibs. Use care when handling the parts as some are thin and are easily broken. If a part breaks, lay it on a flat surface and cement it back together. The Micro Engineering Rail Nipper #48-102 is excellent for cutting these small parts.

## V. ASSEMBLY

### Bent Assemblies

**1.** Cement two **bent halves (1)** together.

Lay a bent half flat on the work surface with its spacers up. Place another bent half on top of the first with its spacers down. Place a thick, heavy straight edge on each side of the bent assembly to align the edges flush. See fig 3. Be sure all edges of both bent halves are flush with one another. Apply cement between a spacer and the bent half and apply pressure until dry. Repeat at each spacer.

**Tip:** If the bent assembly develops a warp as assembly proceeds, lay the bent on a flat work surface and place weights on it after each work session.

**Tip:** On many bridges, some of the tower or bent legs are shortened to fit the terrain. See the label photo on the kit box. If using a shortened leg(s) cut the bent halves and other parts to the correct length before assembling.

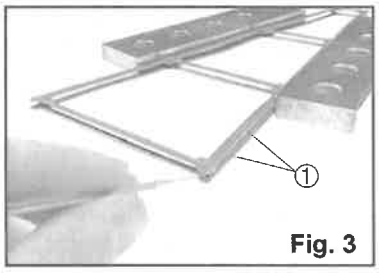


**Fig. 3**

**2.** Cement the **outside bent lattice**, parts **(2)**, **(3)**, **(4)**, and **(5)** to the bent assembly. Figure 4 shows their general position. (For clarity, the parts are shown flat in figure 4, they would actually be on edge if cemented to the bent halves.)

Note that all bent lattice parts have a raised rib along each edge on one face. To assemble the outside bent lattice, lay part **(2)** flat on the work surface with the rib side up. Place the bent assembly on edge on top of part **(2)** so the ribs are on the outside of each bent half. See fig. 5. Cement in place, one edge at a time, while holding the bent half against the rib. Be sure the end of part **(2)** is flush with the end of the bent. Repeat with parts **(3)**, **(4)**, and **(5)**. The eight gusset plate extensions on parts **(2)**, **(3)**, **(4)**, and **(5)** should all extend in the same direction, or up with the bent assembly flat on the work surface. See fig. 5 & 8.

**Note:** If building a four or five story tower using the Tall Steel Viaduct Height Extension kit #75-546 in conjunction with this three story tower, trim off the entire bottom gusset plate on parts **(2)** and **(3)** before cementing them to the bent assembly. Then cement parts **(4)** and **(5)** before parts **(2)** and **(3)** so they can be aligned flush with the top of the bent assembly.

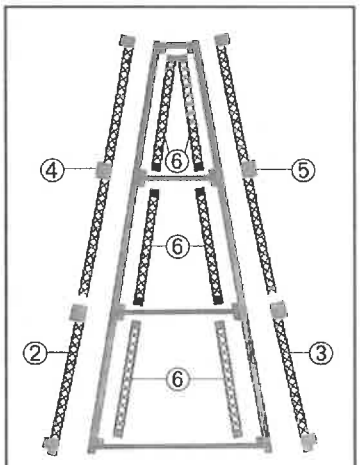


**Fig. 4 Bent lattice**

**3.** Trim the excess plastic from the gusset plates of parts **(6)**, **(7)**, **(8)**, and **(9)** but not **(10)**. Important: See **III. Notes** on page 1.

**4.** Cement the **inside bent lattice** parts **(6)** to the bent assembly. Figure 4 shows their general position.

To assemble, pick up the bent assembly and hold part **(6)** against the bent edges, with its ribs outside each bent half. Apply cement along one edge at a time. See Fig. 6.

**Tip:** Check these parts for fit before cementing as it may be necessary to file the ends shorter so they fit between the bent gusset plates without bowing.

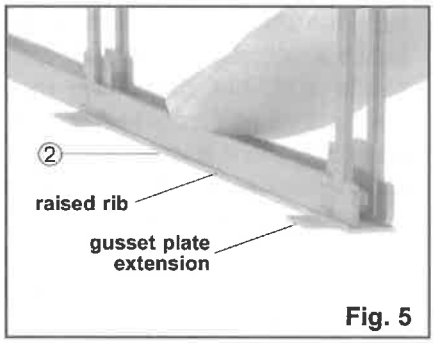


**Fig. 5**

**5.** Cement the upper and lower **bent strut lattice**, parts **(7)**, **(8)**, and **(9)** and **bent strut brace**, part **(10)** to the bent assembly. Figure 7 shows their general position.

Assemble as in step 4. See Fig. 6.

**Tip:** It is easier to install both the upper and lower part of each story at the same time.

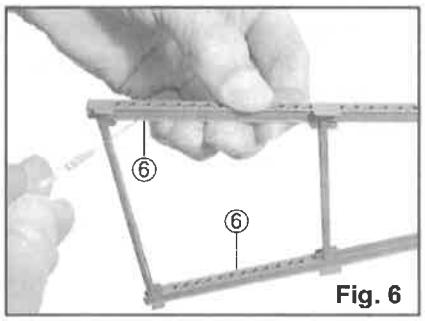


**Fig. 6**

**6.** Cement the **bent X-braces, 3rd, 2nd & 1st story** parts **(11)**, **(12)** and **(13)** to the bent assembly or substitute truss rods for the X-braces as described in step 8. See fig. 1, 8, 10, & 11.

Position, but do not cement, a bent X-brace, part **(11)**, between the bent gusset plates at the upper right corner and lower left corner of the 3rd story. See fig. 8. Position the bent X-brace with the notch facing up and its lattice straps toward the top of the bent. Align the X-brace at each end with the rows of rivets on the bent gusset plates. Position the second bent X-brace, part **(11)**, in the opposite two corners in the same way but with the notch down. Adjust the position of the two X-braces so their slots are centered on

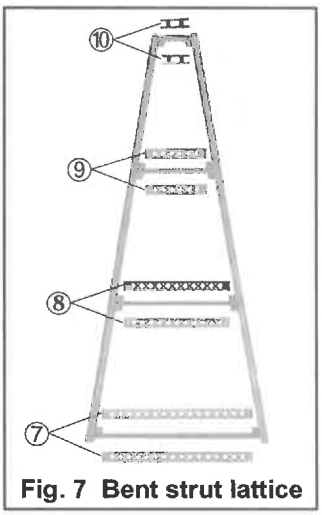


**Fig. 7 Bent strut lattice**

one another. Turn the bent assembly over and adjust the position of each X-brace on the opposite side gusset plates. Once both bent X-braces are positioned correctly, without bow, cement the four ends to the gusset plates on both sides of the bent assembly. Repeat for the 2nd and 1st story X-braces.

**Tip:** If the X-brace bows when positioned in place, it may not be pushed far enough under the gusset plate or it may be a little long. If long, remove the part, trim a little off each end, and check for fit again.

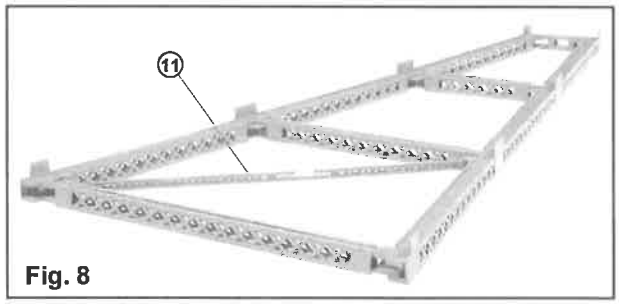


Fig. 8

**Tip:** If the bent assembly is warped, adjust the X-braces as above, place the bent on a flat surface, place weights on it, then readjust and cement the X-braces.

**7.** Cement the **rivet plates** at the intersection of the two X-braces in each story. Use the **large rivet plates** part **(14)** for the 3rd and 2nd story bent X-braces and the **small rivet plates** part **(15)** for the 1st story bent X-braces.

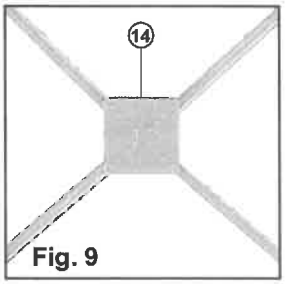


Fig. 9

Apply cement on the edges of the X-braces at their intersection. Using tweezers, place a rivet plate on the cemented area and align the rows of rivets on the rivet plate with the X-braces. See fig. 9. The edges of the rivet plate should also be vertical and horizontal. Once in correct position, apply pressure to the rivet plate so it makes contact and is cemented to all three X-brace edges. Turn the bent assembly over and cement a second rivet plate to the opposite side of the two X-braces. Be sure the two rivet plates are aligned with each other when viewed from either side of the bent assembly.

**Note:** The rows of rivets on the rivet plates will not align precisely with the 2nd story X-braces.

**Tip:** Some rivet plates are easier to align and cement by laying the assembly flat on the work surface and working from the back side.

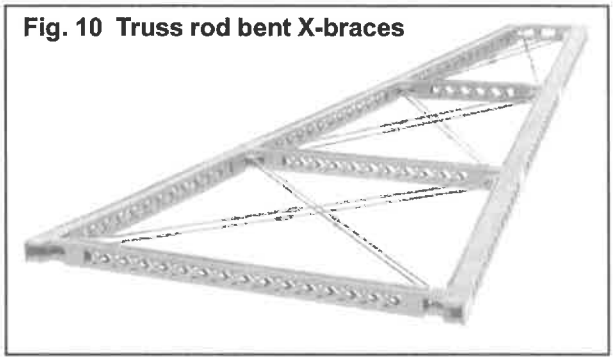


Fig. 10 Truss rod bent X-braces

**8. Truss Rod Modification**: Narrow gauge or light weight steel viaducts often used truss rod X-braces instead of the cross-laced lattice X-braces. To use truss rod bent and tower X-braces, substitute .018" dia. brass wire (not included) and Grandt #4019 turnbuckles (not included) for the bent X-braces parts **(11), (12)** and **(13),** and the tower X-braces part **(20)**. The truss rod modification will require 96 turnbuckles and thirteen 36" lengths of brass wire. See fig. 10 & 11.

**a. Bent truss rods:** Cut the brass wire to 4 9/16" lengths for the 3rd story, 3 7/8" for the 2nd story, and 3 5/16" for the 1st story. Thread a turnbuckle on the wire and cement the wire to the back side of the bent gusset plates with CA cement. Each leg of the X will require a pair of truss rods back to back, so each story will have four truss rods, each bent will have twelve.

**Tip:** The turnbuckles were often located near the center of the truss rods as shown in fig. 10 & 11. Alternatively, they were sometimes located approximately six feet above the bent struts so the turnbuckle could be reached and tightened by a worker standing on the bent strut.

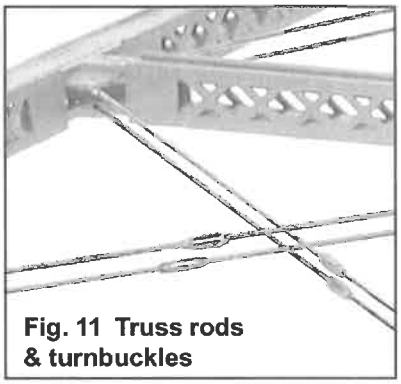


Fig. 11 Truss rods & turnbuckles

**b. Tower truss rods:** See step 16. Cut the brass wire to 5" lengths for the tower truss rods and assemble in the same manner as the bent truss rods.

**9.** The first bent assembly is complete. Assemble three more bent assemblies.

### Tower Struts

There are a total of eight 1st & 2nd story and four 3rd story tower struts. The 3rd story struts use part **(16)** while the 1st & 2nd story struts use part **(17)**. See fig. 12.

**Exception:** If building a four or five story tower using the Tall Steel Viaduct Height Extension kit #75-546 in conjunction with this three story tower, use part **(17)** for the 1st and 2nd stories but use part **(10)**

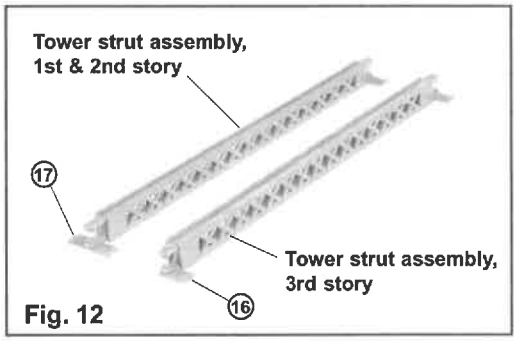


Fig. 12

from the 75-546 kit (identical to part 17) for the 3rd story. Part **(16)** will then be used for the bottom story of the extended 4 or 5 story tower.

**Tip:** When assembling tower struts, it is best to assemble an entire tower strut in one session while the cemented joints still have some flexibility since cementing the fourth side in place helps square up the assembly.

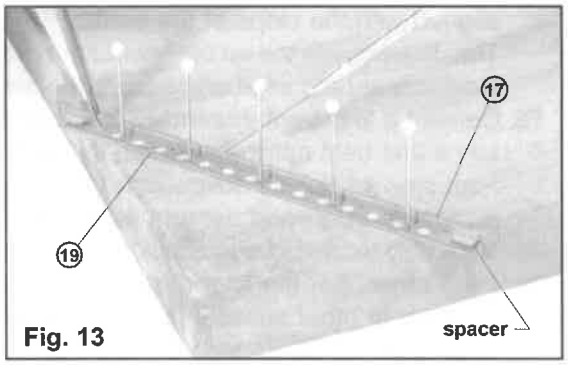


Fig. 13

**10.** Cement a **tower strut side, inside** part **(16)** or **(17)** to a **tower strut lattice** part **(19)**. See the exception note above.

On a block of soft wood or a piece of cardboard, place part **(19)** with the rib side up, across a corner of the block so both ends overhang the block slightly. See fig. 13. Pin the part to the block with several straight pins so it cannot move. Place part **(17)** on edge on part **(19)**, against the inside of the raised rib, with the spacers to the inside and flush with the ends of part **(19)**. Apply cement along the rib, making sure part **(17)** is vertical and perpendicular to part **(19)**. Use the plates at each end for reference.

**11.** Cement a **tower strut side, outside** part **(18)** to the tower strut assembly.

Place part **(18)** on edge on part **(19)**, against the inside of the other raised rib. Be sure the small spacers on part **(18)** are to the inside. Align both ends with the ends of part **(17)** and apply cement along the rib. Also apply cement between the large spacers and part **(18)**. Be sure part **(18)** is vertical and perpendicular to part **(19)**.

**12.** Cement a second **tower strut lattice** part **(19)** to the top of the tower strut assembly.

To assemble, remove the straight pins, pick up the tower strut assembly, and hold part **(19)** against the assembly (similar to fig. 6) with its rivet detail and its ribs to the outside. Apply cement along the ribs while applying pressure.

**13.** The first tower strut is complete. Assemble eleven more tower struts.

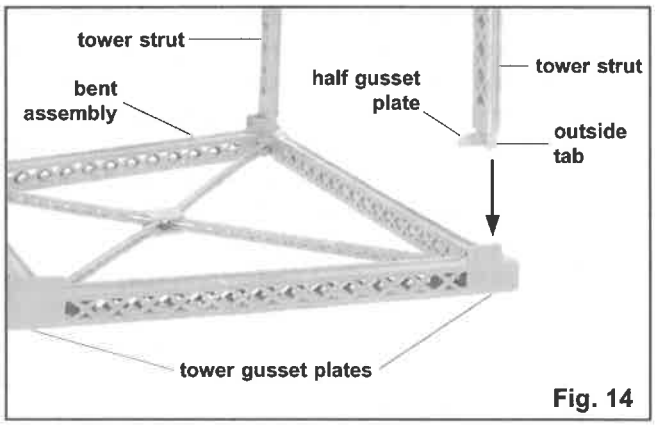


Fig. 14

### Tower Assemblies

**14.** Cement six **tower struts** to a **bent assembly**.

**a.** Lay a bent assembly flat on the work surface with the gusset plate extensions up. Holding a tower strut vertically, place its end on the bent assembly, with its gusset plate to the inside. See fig. 14. The two tower struts with half gusset plates are used at the bottom of the bent, with the half gusset plates toward the top of the bent assembly.

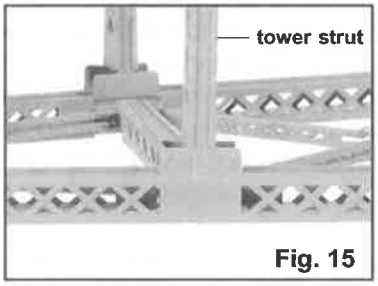


Fig. 15

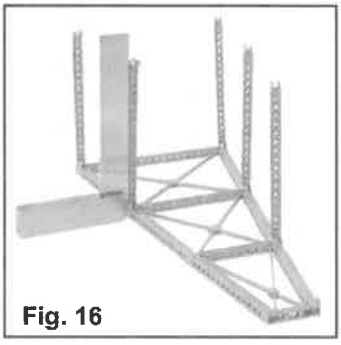


Fig. 16

**b.** Check that the ends of the lattice on the tower strut will butt against the tower gusset plate on the bent assembly. See fig. 15. It will probably be necessary to shorten the tower strut for correct fit. Start by trimming off a small amount of the outside tab then, if necessary, file down some of the edge of the half or full gusset plate. Also, see the **Tip** in d. below.

**Tip:** Check the fit of both ends of each tower strut to both bent assemblies at this time since it will be difficult to trim the second end later. Check the fit at the actual location on the bent assemblies where each tower strut will be cemented.

**c.** Put cement only on the outside tab of the tower strut and press this tab against the inside of the tower gusset plate with tweezers. See fig. 14.

**d.** Position each tower strut as follows; **1.** so it is aligned with the double row of rivets on the tower gusset plate. See fig. 15; **2.** with the tower flat on the work surface, place a square on the work surface and check that the tower strut is square in both planes, perpendicular to and in line to the tower. See fig. 16; **3.** looking from above, the tower strut should be slightly twisted so it is


Fig. 17

aligned with the slope of the bent.

**Tip:** The outside tab on the tower strut or the tower gusset plate on the bent assembly can be twisted or bent with tweezers to help align and square the tower strut.

**15.** Cement a 2nd **bent assembly** to the opposite ends of the six **tower struts**.

Lay a 2nd bent assembly flat on the work surface with the gusset plate extensions up. Hold the tower assembly from step 14 upside down (with the tower struts down) and place the ends of the tower struts on the 2nd bent assembly. Align and cement each tower strut to the 2nd bent assembly as done in step 14. View the tower assembly from above to check the squareness of the bent assemblies to each other. Set the tower upright and use angle plates, a square and weights, or other suitable tools to hold the tower square as the cement dries. See fig. 17.

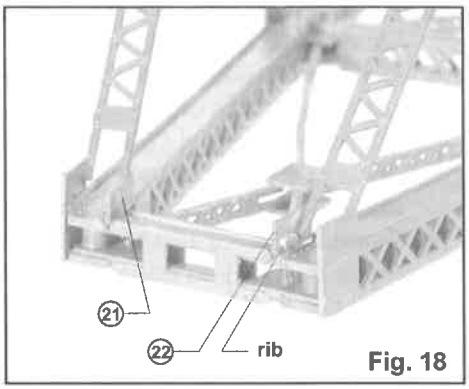


Fig. 18

**16.** Cement the **tower X-braces** part **(20)** to the tower assembly or substitute truss rods for the X-braces as described in step 8.

The tower X-braces are assembled in the same manner as the bent X-braces. Follow the instructions in step 6. Part **(20)** is used for all three stories, on both sides of the tower. Be sure the lattice straps on the X-braces are facing the top of the tower. After positioning but before cementing the X-braces in place, use angle plates, a square and weights, or other suitable tools to hold the tower square. See fig. 17. Once the tower is square and the X-braces are in their correct position, cement the X-braces in place. Note that the top end of the 1st story X-braces can only be cemented to an outside gusset plate until step 17 is completed.

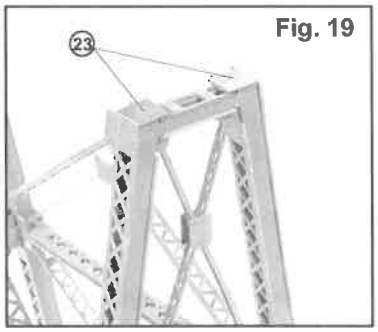


Fig. 19

**17.** Cement the **top tower gusset plates (21)** and **(22)** to the tower.

Lay the tower on its bent side and cement parts **(21)** and **(22)** to the bent assemblies and to the 1st story tower X-braces. Align these parts so the rib is to the inside, down, and toward the top of the tower. Part **(21)** is cemented on the left side, part **(22)** on the right. See fig. 18.

**18.** Cement the **large rivet plates** part **(14)** at the intersection of the two X-braces in all three stories and on both sides of the tower.

The tower rivet plates are assembled in a similar manner to the bent rivet plates. Follow the instructions in step 7. Lay the tower on its back and cement a rivet plate on the outside of one X-brace intersection. Then turn the tower over and cement a rivet plate to the inside of the same X-brace intersection.

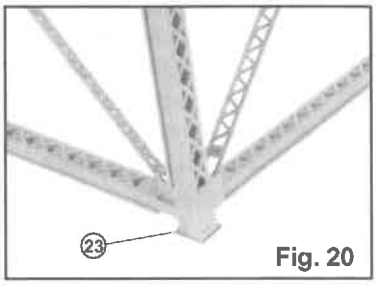


Fig. 20

**19.** Cement the **bearing plates** part **(23)** to the top and bottom of the tower.

Position the top bearing plates so they are on top of the bent ends but against the edge of the tower gusset plates and are flush with the outside of the bent. See fig. 19. Position the bottom bearing plates against the bottom of the bents, centered on the four sides of the bent leg. See fig. 20. File or sand the edge of parts **(21)** and **(22)** and the bottom edges of the bent legs, if necessary, so the bearing plates sit level.

**20.** The first tower is complete. Assemble the second tower.

### Bridge Spans - straight track bridges

The 150 ft. Tall Steel Viaduct uses five 30 foot bridge spans, three are connecting spans, two are tower spans. The 210 ft. Tall Steel Viaduct uses three 50 foot connecting spans and two 30 foot tower spans. See fig. 1.

**Note:** If you are building a curved bridge, some of the girders will need to be shortened before assembling the spans. See **Bridge Spans - curved track bridges** on page 8 before assembling the bridge spans. Also see fig. 35.

**21.** Orient the **30'** or **50' girder** part **(24)** or **(28)** correctly on the work surface.

Note that the girders have a number of vertical angles, each with an adjacent row of rivets. See fig. 21. The bridge span should be assembled so the row of rivets on the

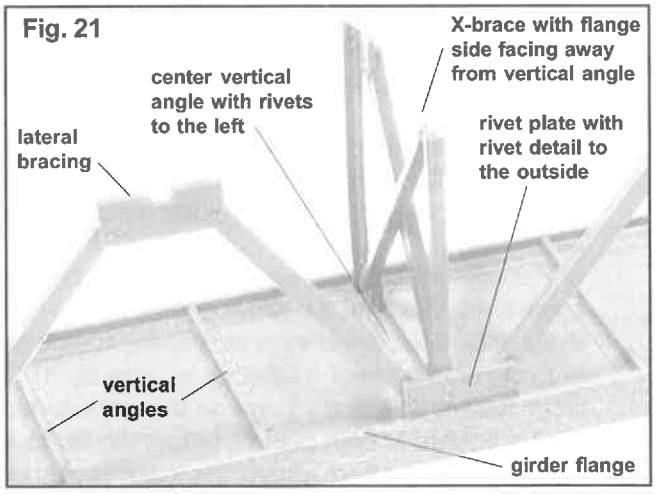


Fig. 21

center vertical angles, on the inside face of both girders, are toward the same end of the bridge. Place a girder on the work surface so the row of rivets on the center vertical angle is to the left. With the girder in this position, the lateral bracing will be cemented to the bottom edge of the girder.

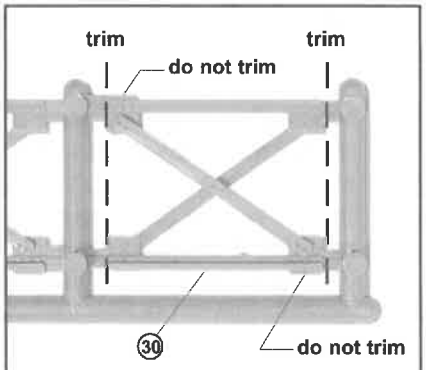


**Fig. 22 50 ft. X-Brace**

**22.** Cement a **30'** or **50' lateral bracing** part **(25)** or **(29)** to the girder.
Hold a lateral bracing on edge with the three (or five) rivet plates down and the rivet detail to the outside of the bridge. See fig. 21. Match the notches in the rivet plates with the appropriate vertical angles on the girder. Starting at the center vertical angle cement the rivet plates against the inside edge of the girder flange. Hold the rivet plates square to the girder while the cement dries.
**Note:** On 50 ft. spans, check the lateral bracing for fit before cementing as it will be necessary to file the slots in the two end rivet plates for proper fit to their vertical angles.
**Tip:** To avoid breakage when cutting the lateral bracing from its runner, place the part on the cutting board with the runner off one edge of the board.

**23.** For connecting spans only, cement the second **30'** or **50' lateral bracing** part **(25)** or **(29)** to the second girder. Align and cement the girder and lateral bracing in the same way as the first girder in steps 21 & 22.
**Note:** The connecting spans use two lateral bracings while the tower spans use only one lateral bracing installed along the top edge of the span.

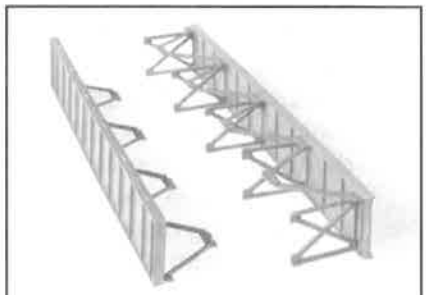


**Fig. 23 50 ft. connecting span**

**24.** Cement the **30'** or **50' X-braces** part **(26)** or **(30)** to a girder that has lateral bracing on it.
Note that the girder X-braces have three angle flanges on one side (called the 'flange side') and one angle flange on the opposite side. Place an X-brace on the girder, positioned on the rivet side of the center vertical angle with its flange side facing away from the vertical angle. See fig. 21. Cement the X-brace against the vertical angle and against the lateral bracing rivet plate, holding it square while the glue dries. Cement the other two (or four) X-braces to the same girder locating them at the other lateral bracing rivet plates. Position them in the same manner, i.e. on the rivet side of the vertical angles and with their flange side facing away from their vertical angles. Some of the X-braces will be facing left, some will face right.
**Note:** On 50' X-braces there is a spacer that looks similar to a gate on two diagonal corners. Do not cut the spacers off when trimming off the four gates. See fig. 22.

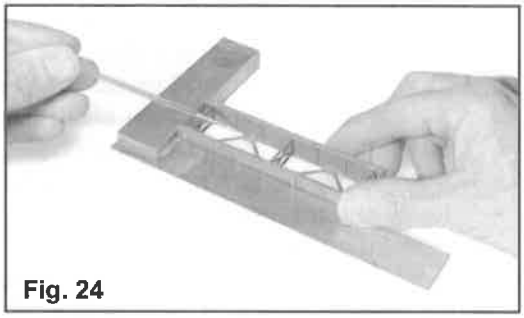


**Fig. 24**

**25.** Cement the two **girder assemblies** together to form a span.
Place one of the girders on edge with the lateral bracing down. Place the other girder on edge with the lateral bracing up and slide the two assemblies together. See fig. 23. For tower spans, which have only one lateral brace, make sure the inside face of both girders are aligned properly as described in step 21. Use rubber bands to hold the span assembly together while positioning the bracing as described in steps 22 and 24. Cement the X-braces to the opposite girder. For the bridge deck to align properly span to span, it is important that the two girders of each span be square. As with a prototype bridge the lateral bracing keeps the girders square to each other. Remove the rubber bands and place the girder assembly in a square as shown in fig. 24. Cement the lateral bracing while holding the girders against the square.
**Tip:** Assemble the span in one work session, cementing the lateral bracing immediately after cementing the X-braces so it is easier to square up the span.
**Note:** On 50 ft. lateral bracing there are notches in the short side rivet plates that will not align with anything when the girders are assembled.

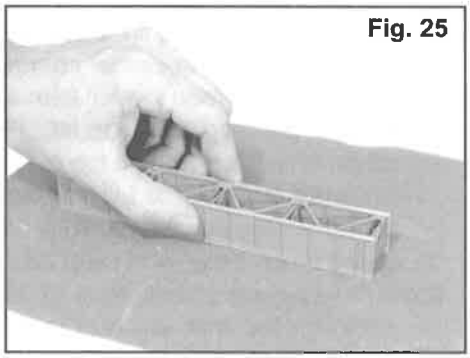


**Fig. 25**

**26.** After the cement has dried sufficiently, place the span on a sanding block and sand off the draft angle and parting line from the edges of the top, bottom, and ends of the girders. See fig. 25.
**27.** The bridge span is complete. Assemble four more bridge spans for a total of three connecting spans and two tower spans.

**Bridge Spans - curved track bridges**

Construction - To build a curved TSV bridge the spans are assembled at an angle to one another. To do this, some or all of the girders on the inside of the curve will need to be shortened before assembling the spans. Which inside girders to trim and how much to trim are determined by the **radius** of the curve, the **joint lengths** at each joint (where two spans meet) and the **joint type**.

Configurations - TSV bridges can be built in several different configurations utilizing various components. See fig. 1.

- **Span types**: are **tower spans** or **connecting spans**.
- **Joint lengths**: can be a 50 ft. to 50 ft. span, a 50 ft. to 30 ft. or a 30 ft. to 30 ft.
- **Joint types**: joints supported by towers are **tower joints**, by bents are **bent joints**, by abutments (at the ends of the bridge) are **abutment joints** .

The bridges in these instructions use 50 ft. to 30 ft. **joint lengths** (75-515) and 30 ft. to 30. ft. **joint lengths** (75-514) and there are no 50 ft. to 50 ft. **joint lengths** or **bent joints**.

Radius determination - There is a minimum **radius** for TSV bridges as determined by the tie overhang of the girder edge. See table 1 & fig. 26. The curve causes the ties to be displaced from their straight track positions. If the curve is too sharp, the ties will not overhang the edge of the girders enough for prototypical appearance. Table 1 also lists the span angle and tie overhang for reference.

**Tip:** The pdf document **Curved Tall Steel Viaducts** is available from Micro Engineering. It has more details including a table listing the trim amount for all three types of **joint lengths**, 50 ft. to 50 ft., 50 ft. to 30 ft. and 30 ft. to 30 ft.

**Table 1 Girder trim amounts for curved TSV bridges**

| Curved Track Radius | Joint Lengths | | | | | |
|---|---|---|---|---|---|---|
| | 50 ft to 30 ft Spans | | | 30 ft to 30 ft Spans | | |
| | Trim Amt. | Span Angle | Tie Over-hang | Trim Amt. | Span Angle | Tie Over-hang |
| Str Trk | 0 | 0 | .120" | 0 | 0 | .135" |
| 18" R | — | — | — | .220" | 12.9° | .075" |
| 21" R | — | — | — | .189" | 11.0° | .084" |
| 24" R | — | — | — | .166" | 9.7° | .090" |
| 27" R | — | — | — | .148" | 8.6° | .095" |
| 30" R | .178" | 10.4° | .021" | .134" | 7.8° | .099" |
| 36" R | .149" | 8.7° | .037" | .112" | 6.5° | .105" |
| 42" R | .128" | 7.4° | .049" | .096" | 5.6° | .109" |
| 48" R | .112" | 6.5° | .058" | .084" | 4.9° | .113" |

**Table 2 Amount to trim and girders to trim**

How much to trim, full or half, & which girder ends to trim are determined by the joint type.

| Joint type | Amount to trim | Girder(s) to trim |
|---|---|---|
| Tower joints | Full trim amount | Connecting span girder only. The tower span girder is not trimmed, it must remain full length to fit the towers properly. |
| Bent joints | Half trim amount | Both connecting span girders. |
| Abutment joints | Half trim amount | Connecting span girder, at the abutment end. |

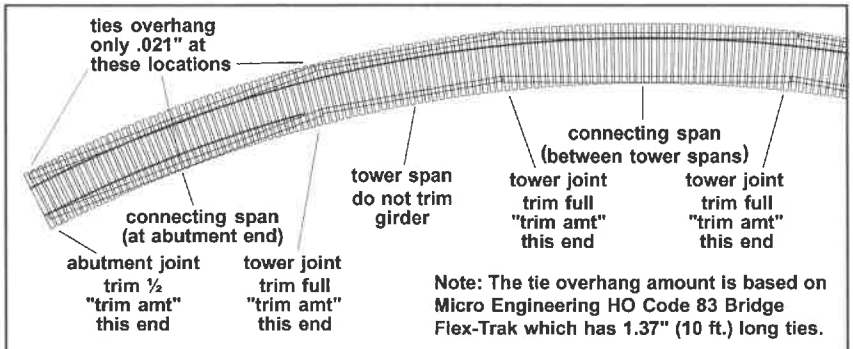


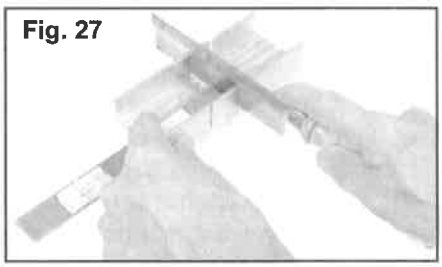

**Fig. 26 HO 210' bridge with a 30" radius curve (only 3 spans shown)**

**28.** Use table 1 to determine the **trim amount** for the track **radius** and **joint length** at each joint. Then use table 2 to determine whether to trim by the full **trim amount** or half the **trim amount** and which girder(s) to trim based on the **joint type** at each joint.

Since the bridges in these instructions use **connecting spans**, **tower spans**, **tower joints** and **abutment joints**, it can be seen from table 2 that some of the inside girders will be trimmed the full **trim amount** and some will be trimmed half the **trim amount**. See fig. 26.

**29.** Assemble the two 30 foot **tower spans** full length, without modification as described in steps 21-26.

**30.** On the work surface, lay out and orient the six girders for the three **connecting spans** as described in step 21. Use table 1 & 2 and fig. 26 to determine how much should be trimmed off the girders for the track radius you will use. Note that the center connecting span is trimmed the full **trim amount** off each end. The end connecting spans are trimmed the full **trim amount** off the end that joins a tower span but are trimmed only one half the **trim amount** off the end that joins the abutments. Use tape on the outside face of the inside girders to mark which ends are trimmed the full **trim amount** and which are trimmed half the **trim amount**. See fig. 26, 27, 28 & 30.




**31.** Using a razor saw and miter box trim both ends of the inside girders of the three **connecting spans**. See fig. 27.

Although the **trim amount** in the table is shown in thousands of an inch, the actual amount trimmed is not particularly critical if your layout allows

you to adjust the track radius to match the assembled bridge. It is important to be consistent when trimming each girder so the angle between girders is the same at each joint allowing a consistent radius throughout the curve.

**32.** Assemble the three **connecting spans** following steps 21-27 but with the following additions or changes:

**Step 22.** Fit a **30'** or **50' lateral bracing** part **(25)** or **(29)** to a shortened girder and then trim the end rivet plates on the lateral bracing as necessary so they do not extend past the ends of the girder. Cement the trimmed lateral bracing to the shortened girder.

**Step 23.** Cement the second **30'** or **50' lateral bracing** part **(25)** or **(29)** to a full length girder.

**Step 24.** Cement the **30'** or **50' X-braces** part **(26)** or **(30)** to the shortened girder. It may be necessary to locate the end X-braces on the opposite side (non-rivet side) of the vertical angles if the rivet side has been trimmed off. These X-braces should still face the same direction as if located in their normal position.

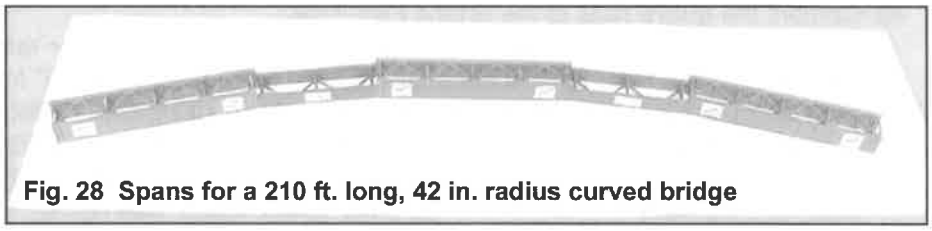


**Fig. 28 Spans for a 210 ft. long, 42 in. radius curved bridge**

**Step 25.** When cementing the two girder assemblies together for each span, only the two **tower spans** can utilize the square as shown in fig. 24. Since the **connecting spans** have a shortened girder, the square cannot be placed against the girder ends. Instead, place the square against a vertical angle on the outside of one girder and visually align it with the corresponding vertical angle on the inside of the other girder.

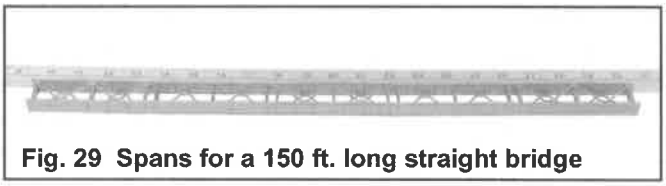


**Fig. 29 Spans for a 150 ft. long straight bridge**

### Bridge Deck

**33.** Fit and cement the five **bridge spans** together.

Place the five spans end to end on a flat work surface. Position the tower spans so their lateral bracing side is down, against the work surface. In this position the spans are up-side-down, the surface against the work surface will be the top of the bridge. On each span, sand the girder ends, as necessary so they make full contact and are square against the girder ends of the adjacent span. For a curved bridge, make a full size drawing showing the locations of the angled spans for the track radius used (similar to fig. 26 but without ties). Use the drawing as a template to file or sand the shortened girders to attain the proper angle and alignment between spans. See fig. 28. For a straight track bridge, use a straight edge to align the five spans. See fig. 29. Apply cement between the girder ends to cement the five spans together. Use weights on the spans to insure that the track side of the girders are flush with each other.

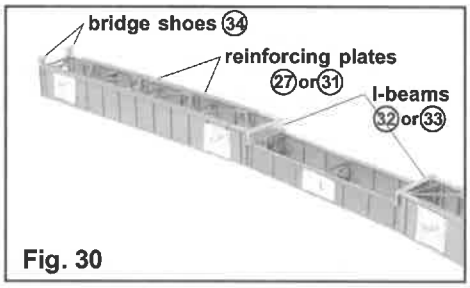



**Fig. 30**

**34.** For connecting spans only, center and cement the **30'** or **50' reinforcing plates** part **(27)** or **(31)** to the bottom edge of each girder.

Be sure the reinforcing plates are on the correct side, i.e. bottom side of the span. See fig. 30.

**Note:** Reinforcing plates are used only on connecting spans and are not used on tower spans.

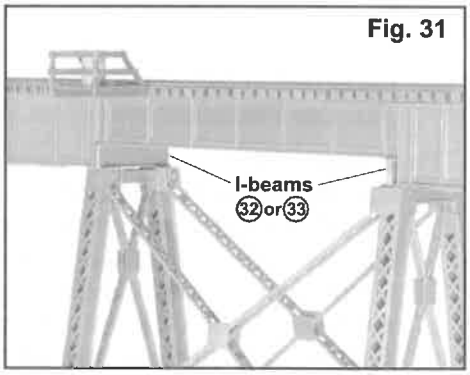



**Fig. 31**

**35.** If building a 210 ft. bridge, cement the **I-beam** part **(32)** or **(33)** to the bottom of the 30 ft. spans at both ends.

The I-beams are needed so the 30 ft. spans are supported at the correct height on the towers. See fig. 30 & 31.

**Tip:** Check these parts for fit before cementing. The I-beams must be flush with the bottom of the adjacent 50 ft. span and may require sanding or filing. Also sand or file the parting lines from the ends of the I-beams.

**36.** Cement a **bridge shoe** part **(34)** to the end of each girder at the abutment ends of the bridge. See fig. 30.

**Tip:** Use CA cement for the white metal bridge shoes.

**37.** Paint and weather the **towers** and **bridge deck** at this point, before installing track and final assembly.

### Bridge Track

Micro Engineering Code 83 or Code 70 **Bridge Flex-Trak** is available separately in 36" lengths and includes a pair of lighter weight guard rails, guard timbers with bolt head detail, and four barrel platforms with barrels. The track is not included with the Tall Steel Viaduct kit because a one piece length needed to span the bridge does not fit in the kit box. The following instructions are for use with the Micro Engineering Bridge Flex-Trak.

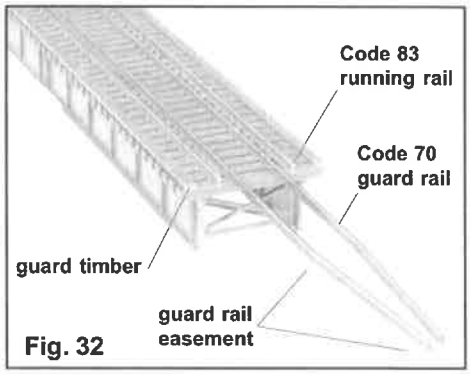


Fig. 32

**38.** Shape the **Bridge Flex-Trak** to fit the straight or curved bridge deck.
Use the bridge deck, a straight edge, or a drawing as a guide to bend the track so it fits the deck properly. Adjust the ties so they are spaced evenly. Trim the track ends longer than the bridge deck, extending them onto the regular track.

**39.** Cement the **guard timbers** to the top of the ties.
Position the guard timbers, with the bolt head detail up, two scale inches (.023") in from the tie ends. See fig. 32. For curved bridges trim the guard timbers as needed and install them at an angle to follow the curvature.

**40.** Cement the **guard rails** to the Bridge Flex-Trak.
On prototype bridges the guard rails were usually made of lighter rail than the running rails. Extend the guard rails 20 to 40 scale feet (2□" to 5□") off the ends of the bridge, onto the regular track. Using CA or Pliobond, cement the guard rails between the rows of guard rail spikes molded on the Bridge Flex-Trak. Form the easement at the guard rail ends by curving the last 1" to 2" of the guard rails in toward the track center until the rail ends almost touch. See fig. 32.

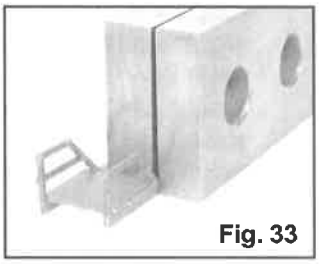


Fig. 33

**41.** Assemble the **barrel platforms**.
Use two weights to hold the right frame upright, with its railings to the outside. Place the platform on the right frame with the planks running side to side and then slide the left frame under the platform. See fig. 33. Position the platform square with the right frame and flush with the outside face of the side railings and apply cement. Repeat for the left side frame. Cement the two back railings in place with their wood grain detail to the outside. Position and cement the barrel, without its lid, in the center of the platform. Do not attach the barrel platforms to the track yet.
**Note:** Barrel platforms were used during the steam era to extinguish fires on bridge decks. Use one or two Barrel platforms on the 150 ft. bridge spaced one half or one quarter of the bridge length in from each end. The 210 ft. bridge would use two or three barrel platforms spaced one quarter or one sixth of the bridge length in from each end.

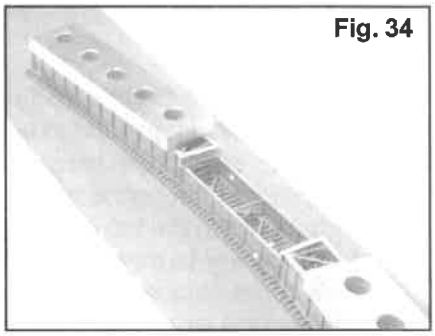


Fig. 34

**42.** Paint and weather the **Bridge Flex-Trak** and **barrel platforms** at this point.

**43.** Cement the **Bridge Flex-Trak** to the **bridge deck**.
Lay the bridge track up-side-down on a piece of cardboard and position the bridge deck in place on top of the track so it is aligned correctly with relation to the ties. Place a pair of straight pins on each side of a girder in several places. See fig. 34. Remove the deck and apply cement to the top edges of the girders. Put the bridge deck back in place on the ties and place weights on the deck until the cement dries.
**Tip:** Use Pliobond cement, cat. no. 49-102 to cement the bridge deck to the track ties.

### Final Assembly

**44.** Cement the **barrel platforms** in place between ties.
Locate the barrel platforms on the bridge as outlined in step 41. Insert the frame timbers between ties and push the platforms in until the diagonal frames are just short of the guard timbers on the Bridge Flex-Trak. See fig. 31. Cement the side of the platform timbers to the side of the ties with CA cement. Be sure the platforms are level.
**Tip:** If the platforms sag, lightly sand or file the bottom of the main frame members.

**45.** Cement the **bridge deck** in place on top of the **towers**.
Place the finished towers on the work surface. Place the bridge deck on the towers and adjust the placement of the towers so the 30 foot spans are centered on their respective towers. See fig. 35.

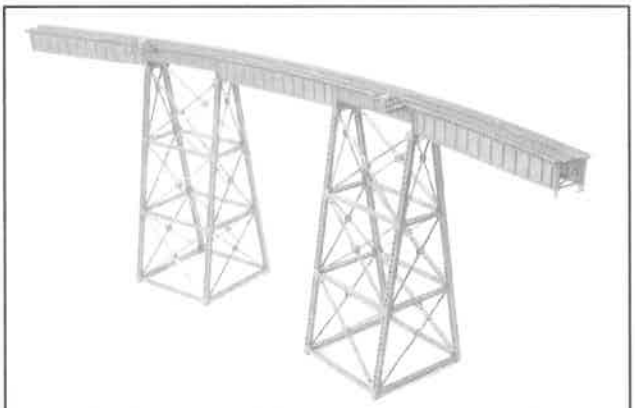


**Fig. 35 Finished 210 ft, 42 in radius curved Tall Steel Viaduct**

**46.** Install the **finished bridge** on your layout.
The bridge shoes should rest on bridge abutments and the towers on bridge piers, installed on your layout.